

Escherichia coli 0157:H7



Section 1:

ABOUT THE DISEASE

A. Etiologic Agent

Escherichia coli 0157:H7 is one of over a hundred different serotypes of the gram negative bacteria *E. coli*, the majority of which are normal inhabitants of the bowel and are benign to humans. *E. coli* 0157:H7 is in the enterohemorrhagic (EHEC) category of strains.

B. Clinical Description

E. coli 0157:H7 produces potent cytotoxins, called Shiga toxins. Infection with *E. coli* 0157:H7 may present with a wide spectrum of clinical manifestations. An individual may be asymptomatic, may have mild, non-bloody diarrhea, or may have grossly bloody diarrhea. Most diagnosed cases present with bloody diarrhea 6–48 hours after the onset of non-bloody diarrhea. Abdominal pain, abdominal cramps, nausea, and vomiting may also be present. Fever is usually absent. The most severe clinical manifestations of this infection are hemolytic uremic syndrome (HUS) and thrombotic thrombocytopenic purpura (TTP), which can result in renal failure and death.

C. Vectors and Reservoirs

Cattle appear to be a reservoir of significant public health importance; however, other animals, such as deer, are also known to carry *E. coli* 0157:H7. In addition, humans may also serve as a reservoir.

D. Modes of Transmission

Transmission of *E. coli* 0157:H7 occurs by fecal-oral transmission through food, drinking water, or recreational water contaminated with human or animal feces containing the bacteria. Transmission may also occur directly from person to person, including by sexual contact (e.g., oral-anal contact). The infectious dose is very low. *E. coli* 0157:H7 infection has been associated with the consumption of contaminated ground beef, unpasteurized apple juice and cider, unpasteurized milk and other dairy products, raw vegetables, and salami.

E. Incubation Period

The incubation period for *E. coli* 0157:H7 infection is usually 3–4 days, but it can range from 1–10 days.

F. Period of Communicability or Infectious Period

E. coli 0157:H7 is shed in stool during the initial period of diarrhea, then for a variable duration afterward. It is typically shed for one week or less in adults, but for up to three weeks in about one-third of infected children. Long-term carriage is uncommon.

G. Epidemiology

E. coli 0157:H7 was first identified in a 1982 outbreak in the U.S. Since then, infections have been recognized as an important cause of bloody diarrhea in North America, Europe, Japan, Australia, southern Africa, and southern South America. As with other enteric illnesses, the young and old are usually more severely ill when infected with *E. coli*

O157:H7. Infection in young children may lead to complications such as HUS in about 5–10% of cases. Sporadic cases of *E. coli* O157:H7 infection occur throughout the year, with a peak in the incidence of disease during the summer months. Outbreaks in the U.S. have been associated with ground beef, unpasteurized milk and apple cider, and other food products.

H. Bioterrorist Potential

E. coli O157:H7 is listed by the Centers for Disease Control and Prevention (CDC) as a Category B bioterrorist agent. If acquired and properly disseminated, *E. coli* O157:H7 could cause a serious public health challenge.



Section 2:

REPORTING CRITERIA AND LABORATORY TESTING

A. What to Report to the Massachusetts Department of Public Health (MDPH)

Report a case that meets the following criteria:

- ◆ Isolation of *E. coli* O157:H7 from a clinical specimen; or
- ◆ Isolation of Shiga toxin-producing *E. coli* O157:NM from a clinical specimen. (Strains of *E. coli* O157:H7 that have lost the flagellar “H” antigen become nonmotile and are designated “NM.”)

Note: See Section 3C for information on how to report a case.

B. Laboratory Testing Services Available

The MDPH State Laboratory Institute (SLI), Enteric Laboratory will test stool specimens for the presence of *E. coli* O157:H7 and will confirm and serotype isolates from clinical specimens from other laboratories. Additionally, the SLI Enteric Laboratory requests that all laboratories submit all isolates for typing to aid in public health surveillance.

For more information on submitting specimens, call the SLI Enteric Laboratory at (617) 983-6609. The SLI Food Microbiology Laboratory, at (617) 983-6616, will test food items implicated in a cluster or outbreak. See Section 4D for more information.



Section 3:

REPORTING RESPONSIBILITIES AND CASE INVESTIGATION**A. Purpose of Surveillance and Reporting**

- ◆ To identify whether the case may be a source of infection for other persons (e.g., a diapered child, daycare attendee, or food handler), and if so, to prevent further transmission.
- ◆ To identify sources of public health concern (e.g., a contaminated food source or recreational water), and to stop transmission from such a source.

B. Laboratory and Health Care Provider Reporting Requirements

E. coli O157:H7 is reportable to the local board of health (LBOH). The MDPH requests that health care providers immediately report to the LBOH in the community where the case is diagnosed, all confirmed or suspect cases of *E. coli* O157:H7 infection, as defined by the reporting criteria in Section 2A.

Laboratories performing examinations on any specimens derived from Massachusetts residents that yield evidence of *E. coli* O157:H7 or *E. coli* O157:NM shall report such evidence of infection directly to the MDPH within 24 hours.

C. Local Board of Health (LBOH) Reporting and Follow-Up Responsibilities*Reporting Requirements*

MDPH regulations (*105 CMR 300.000*) stipulate that *E. coli* O157:H7 is reportable to the LBOH and that each LBOH must report any confirmed case of *E. coli* O157:H7 or suspect case of *E. coli* O157:H7, as defined by the reporting criteria in Section 2A. Cases should be reported to the MDPH Bureau of Communicable Disease Control, Office of Integrated Surveillance and Informatics Services (ISIS) using an official MDPH *Enteric Disease Case Report Form* (found at the end of this chapter). Refer to the *Local Board of Health Timeline* at the end of this manual's *Introduction* section for information on prioritization and timeliness requirements of reporting and case investigation.

Case Investigation

1. It is the responsibility of the LBOH to complete a MDPH *Enteric Disease Case Report Form* (found at the end of this chapter) by interviewing the case and others who may be able to provide pertinent information. Much of the information required on the form can be obtained from the health care provider or from the medical record.
2. Use the following guidelines to assist in completing the form:
 - a. Accurately record the demographic information, date of symptom onset, symptoms, and medical information.
 - b. Accurately record all available clinical information, including onset date, symptoms, information regarding hospitalization, and clinician contact information.
 - c. Indicate *E. coli* O157:H7 as the etiologic agent.
 - d. When asking about exposure history (e.g., food, travel, activities), if possible, use the entire incubation period range of *E. coli* O157:H7 (1–10 days). Specifically, however, focus on the 3–4 days prior to the case's onset, which is the usual range.
 - e. Record information pertaining to the case's possible exposures, including any restaurants at which the case ate, food item(s) consumed, and date(s) of consumption. If you suspect that the case became infected

through food, use the MDPH *Foodborne Illness Complaint Worksheet* (found at the end of this chapter) to facilitate recording additional information. It is requested that LBOH fax or mail this worksheet to the MDPH Center for Environmental Health, Food Protection Program (FPP); see top of worksheet for fax number and address. This information is entered into a database to help link other complaints from neighboring towns, thus helping to identify foodborne illness outbreaks. *Note: This worksheet does not replace the MDPH Enteric Disease Case Report Form.*

- f. Ask questions about travel history and outdoor activities to help identify where the case became infected.
 - g. Ask questions about water supply because *E. coli* O157:H7 may be acquired through water consumption. Record this information in the “Comments” section.
 - h. Household/close contact, pet or other animal contact, daycare, and food handler questions are designed to examine the case’s risk of having acquired the illness or the case’s potential for transmitting it in a particular setting. Determine whether the case attends or works at a daycare facility and/or is a food handler.
 - i. If you have made several attempts to obtain case information but have been unsuccessful (e.g., the case or health care provider does not return your calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please fill out the case report form with as much information as you have gathered. Please note on the form the reason(s) why it could not be filled out completely.
3. After completing the form, attach laboratory report(s) and fax or mail (in an envelope marked “Confidential”) to ISIS. The confidential fax number is (617) 983-6813. Call ISIS at (617) 983-6801 to confirm receipt of your fax. The mailing address is:

MDPH, Office of Integrated Surveillance and Informatics Services (ISIS)
305 South Street, 5th Floor
Jamaica Plain, MA 02130
Fax: (617) 983-6813

4. Institution of disease control measures is an integral part of case investigation. It is the responsibility of the LBOH to understand, and if necessary, institute the control guidelines listed in Section 4.



Section 4:

CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (105 CMR 300.200)

Food handlers with *E. coli* O157:H7 infection or carriage must be excluded from work.

Note: A case is defined by the reporting criteria in Section 2A of this chapter.

Minimum Period of Isolation of Patient

After diarrhea has resolved, food handlers may return to food handling duties only after producing 2 negative stool specimens, taken at least 48 hours apart. If a case was treated with an antimicrobial, the stool specimen shall not be collected until at least 48 hours after cessation of therapy.

Minimum Period of Quarantine of Contacts

Contacts with diarrhea who are food handlers shall be considered the same as a case and shall be handled in the same fashion. In outbreak circumstances, asymptomatic contacts who are food handlers shall be required to produce 2 negative stool specimens 24 hours apart. No restrictions otherwise.

Note: A food handler is any person directly preparing or handling food. This can include a patient care or childcare provider. See Glossary (at the end of this manual) for a complete definition.

B. Protection of Contacts of a Case

None.

C. Managing Special Situations

Daycare

Since *E. coli* O157:H7 may be transmitted from person to person through fecal-oral transmission, it is important to follow up on cases of *E. coli* O157:H7 in a daycare setting carefully. (If a case of HUS is diagnosed in a daycare, please see the chapter entitled *Hemolytic Uremic Syndrome (HUS)* in this manual for recommendations.) General recommendations include:

- ◆ Children with *E. coli* O157:H7 who have diarrhea should be excluded until their diarrhea is resolved.
- ◆ Children with *E. coli* O157:H7 who have no diarrhea and are otherwise not ill may be excluded or may remain in the program if special precautions are taken.

Since most staff in childcare programs are considered food handlers, those with *E. coli* O157:H7 in their stools (symptomatic or not) can remain on site, but they must not prepare food or feed children until their diarrhea is resolved and they have 2 negative stool tests taken at least 48 hours apart and submitted at least 48 hours after completion of antimicrobial therapy, if treatment is received (per *105 CMR 300.200*).

School

Since *E. coli* O157:H7 may be transmitted from person to person through fecal-oral transmission, it is important to follow up on cases of *E. coli* O157:H7 in a school setting carefully. The MDPH *Comprehensive School Health Manual* provides detailed information on case follow-up and control in a school setting. (If a case of HUS is diagnosed in a school, please see the chapter entitled *Hemolytic Uremic Syndrome (HUS)* in this manual for recommendations.) General recommendations include:

- ◆ Students or staff with *E. coli* O157:H7 infection who have diarrhea should be excluded until their diarrhea is resolved.
- ◆ Students or staff with *E. coli* O157:H7 who do not handle food, have no diarrhea or mild diarrhea, and are not otherwise sick, may remain in school if special precautions are taken.
- ◆ Students or staff who handle food and have *E. coli* O157:H7 infection (symptomatic or not) must not prepare food until their diarrhea is resolved and they have 2 negative stool tests taken at least 48 hours apart and submitted at least 48 hours after completion of antimicrobial therapy, if treatment is received (per *105 CMR 300.200*).

Refer to Chapter 8 of the MDPH *Comprehensive School Health Manual* for complete guidelines on handling diseases spread through the intestinal tract.

Community Residential Programs

Actions taken in response to a case of *E. coli* O157:H7 in a community residential program will depend on the type of program and the level of functioning of the residents.

In long-term care facilities, residents with *E. coli* O157:H7 should be placed on standard (including enteric) precautions until their symptoms subside and they have one negative stool test for *E. coli* O157:H7. Staff members who provide direct patient care (e.g., feed patients, give mouth or denture care, or give medications) are considered food handlers and are subject to food handler restrictions under *105 CMR 300.200*. See Section 4A for more information. In addition, staff members with *E. coli* O157:H7 infection who are not food handlers should not work until their diarrhea is resolved.

Refer to the MDPH Division of Epidemiology and Immunization's *Control Guidelines for Long-Term Care Facilities* for further actions. A copy can be obtained by calling the MDPH Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850 or from the MDPH website at www.mass.gov/dph/cdc/epii/lcfc/lcfc.htm.

In residential facilities for the developmentally disabled, staff and clients with *E. coli* O157:H7 infection must refrain from handling or preparing food for residents until their symptoms have subsided and they have 2 negative stool tests taken at least 48 hours apart and collected at least 48 hours after completion of antimicrobial therapy, if treatment is given (per *105 CMR 300.200*). In addition, staff members with *E. coli* O157:H7 infection who are not food handlers should not work until their diarrhea is resolved.

Reported Incidence Is Higher Than Usual/Outbreak Suspected

If the number of reported cases in your city/town is higher than usual or if you suspect an outbreak, investigate clustered cases to determine the source of infection and the mode of transmission. A common vehicle (e.g., water, food, or association with a daycare center) should be sought, and applicable preventive or control measures should be instituted. Control of person-to-person transmission requires special emphasis on personal cleanliness and sanitary disposal of feces. Consult with the epidemiologist on-call at the MDPH Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850. The Division can help determine a course of action to prevent further cases and can perform surveillance for cases across town lines, which would otherwise be difficult to identify at the local level.

D. Preventive Measures

Environmental Measures

Implicated food items must be removed from the environment. A decision about testing implicated food items can be made in consultation with the FPP or the MDPH Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850. The FPP can help coordinate pickup and testing of food samples. If a commercial product is suspected, the FPP will coordinate follow-up with relevant outside agencies. The FPP is reachable at (617) 983-6712.

Note: The role of the FPP is to establish policy and to provide technical assistance with the environmental investigation, such as interpreting the Massachusetts Food Code, conducting a Hazard Analysis and Critical Control Point (HACCP) risk assessment, initiating enforcement actions, and collecting food samples.

The general policy of the SLI is to test only food samples implicated in suspected outbreaks, not single cases (except when botulism is suspected). The LBOH may suggest that the holders of food implicated in single case incidents

locate a private laboratory which will test food or that they store the food in their freezer for a period of time in case additional reports are received. However, leftover food consumed by a single, confirmed case within the incubation period may be considered for testing on occasion.

Note: Refer to the MDPH's Foodborne Illness Investigation and Control Reference Manual for comprehensive information on investigating foodborne illness complaints and outbreaks. Copies of this manual have been made available to the LBOH. It can also be located on the MDPH website in PDF format at www.mass.gov/dph/fpp/refman.htm. For the most recent changes to the Massachusetts Food Code, contact the FPP at (617) 983-6712 or through the MDPH website at www.mass.gov/dph/fpp.

Other environmental measures include:

- ◆ Follow recommended procedures for testing of recreational water supplies (e.g., pools, lakes) for coliforms. Contact the MDPH Community Sanitation Program at (617) 624-5757 for more information.
- ◆ Follow recommended guidelines for the proper washing/brushing of apples at cider-making facilities. The FPP can be reached at (617) 983-6712 for more information.

Personal Preventive Measures/Education

To avoid exposure, advise individuals to:

- ◆ Always wash their hands thoroughly with soap and water before eating or preparing food, after using the toilet, after changing diapers, and after contact with animals, especially cattle.
- ◆ Wash own hands as well as the child's hands after changing a child's diapers, and dispose of diapers in a sanitary manner.
- ◆ Wash their hands thoroughly and frequently when ill with diarrhea, or when caring for someone with diarrhea. Hands should be scrubbed for at least 15–20 seconds after cleaning the bathroom; after using the toilet or helping someone use the toilet; after changing diapers; before handling food; and before eating.
- ◆ If diagnosed with *E. coli* O157:H7, seek medical attention if symptoms compatible with HUS occur. (See chapter entitled *Hemolytic Uremic Syndrome (HUS)* in this manual for more information.)
- ◆ Keep food that will be eaten raw, such as vegetables, from becoming contaminated by animal-derived food products. (Wash fruits and vegetables thoroughly, especially those that will not be cooked.)
- ◆ If served an undercooked hamburger or other undercooked ground beef product in a restaurant, send it back for further cooking.
- ◆ Cook all ground beef and hamburgers thoroughly.
- ◆ Drink only pasteurized milk, juice, or cider.

Discuss transmission risks that may result from oral-anal sexual contact. Latex barrier protection (e.g., dental dam) may prevent the spread of *E. coli* O157:H7 to a case's sexual partners and may prevent exposure to and transmission of other fecal-oral pathogens.

An *E. coli* O157:H7 Public Health Fact Sheet is available from the MDPH Division of Epidemiology and Immunization or on the MDPH website at www.mass.gov/dph. Click on the “Publications and Statistics” link, and select the “Public Health Fact Sheets” section under “Communicable Disease Control.” The fact sheet is also available in Spanish.



ADDITIONAL INFORMATION

The formal CDC surveillance case definition for *E. coli* O157:H7 is the same as the criteria outlined in Section 2A of this chapter. (CDC case definitions are used by the MDPH and the CDC to maintain uniform standards for national reporting.) For reporting to the MDPH, always use the criteria outlined in Section 2A.

Note: The most up-to-date CDC case definitions are available on the CDC website at www.cdc.gov/epo/dphsi/casedef/case_definitions.htm.



REFERENCES

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FORMS & WORKSHEETS
Escherichia coli 0157:H7

Escherichia coli 0157:H7



LBOH Action Steps

*This form does not need to be submitted to the MDPH with the case report form. It is for LBOH use and is meant as a quick-reference guide to *E. coli* 0157:H7 case investigation activities.*

LBOH staff should follow these steps when *E. coli* 0157:H7 is suspected or confirmed in the community. For more detailed information, including disease epidemiology, reporting, case investigation, and follow-up, refer to the preceding chapter.

- ☐ Notify the MDPH Division of Epidemiology and Immunization, at (617) 983-6800 or (888) 658-2850, to report any suspect case(s) of *E. coli* 0157:H7.
- ☐ Obtain laboratory confirmation.
- ☐ For *E. coli* 0157:H7 suspected to be the result of food consumption, complete a MDPH *Foodborne Illness Complaint Worksheet* and forward to the MDPH Center for Environmental Health, Food Protection Program (FPP).
- ☐ Identify potential exposure sources, such as food or water.
- ☐ If recreational water is identified as a potential exposure source, consult with the MDPH Community Sanitation Program at (617) 624-5757.
- ☐ Consult with the MDPH Division of Epidemiology and Immunization regarding the submission of suspect food items for testing.
- ☐ Determine whether the case attends or works at a daycare facility and/or is a food handler.
- ☐ Identify other potentially exposed persons.
- ☐ Fill out the case report form (attach laboratory results).
- ☐ Send the completed case report form (with laboratory results) to the MDPH Bureau of Communicable Disease Control, Office of Integrated Surveillance and Informatics Services (ISIS).